Abstract

The Abstract is objected to as containing more than 150 words. The original abstract has been replaced by a new abstract having fewer than 150 words and the objection is overcome.

Claim Rejections Under 35 U.S.C. 112

Claims 1-57 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite. The Examiner states that these claims fail to recite sufficient structure to define any grating or laser to support the preamble of the claims. Claims 2, 4 and 18 have been cancelled rendering their rejection moot. Claims 1, 3, 8, 46 and 55 to recite specific laser and grating or grism structure. For example, each of Claims 1, 3, 8, 46 and 55, as now amended, recites a laser chamber filled with a gas mixture ..., a plurality of electrodes ..., and a laser resonator .... The recited grating element or grating surface is defined as including a plurality of grooves. The excimer or molecular fluorine laser system of each of Claims 1, 3, 8, 46 and 55 generates a line-narrowed and/or line-selected laser beam. Each of Claims 1, 3, 8, 46 and 55, as now amended, define a functioning and definite invention. Each of Claims 5-7, 9-17, 19-45, 47-54 and 56-61 is dependent upon one or more of Claims 1, 3, 8, 46 and 55. The rejection is overcome.

Claims Rejections Under 35 U.S.C. 102

CLAIMS 1, 2, 3 AND 4 are rejected under 35 U.S.C. 102(b) as being anticipated by United States patent no. 4,009,933 to Firester. Claims 2 and 4 have been cancelled rendering their rejection moot. Claims 1 and 3, as now amended, are allowable for the reasons that follow.

Applicants' invention as set forth at Claim 1 includes an excimer or molecular fluorine laser system, including a laser chamber filled with a gas mixture at least including a halogen-containing species and a buffer gas, multiple electrodes within the laser chamber connected to a discharge circuit energizing the gas mixture, and a laser resonator including the laser chamber and a line-narrowing and/or line-selection package generating an output beam with a bandwidth less than 1 pm. The recited laser

resonator includes a grating element having a dielectric highly-reflective (HR) coating formed thereon. The grating element includes multiple grooves. The grating element selects a narrow band from a broader spectral distribution to continue along the beam path after being incident upon the grating element. The grating element disperses away from the beam path outer portions of the spectral distribution.

As understood, Fig. 1 and column 1, lines 38-47 of Firester, as relied upon by the Examiner, does not disclose all of the features of Applicants' invention as set forth at amended Claim 1. For example, the laser chamber of Applicants' excimer or molecular fluorine laser system is filled with a halogen-containing species and a buffer gas, and Applicants' laser system is of gas discharge type including the multiple electrodes connected to the discharge circuit for energizing the gas mixture within the laser chamber. No such structure is disclosed at the relied upon portions of Firester. Further, Applicants' laser resonator including the recited line-narrowing and/or selection package generates an output beam with a bandwidth of less than 1 pm. The grating of Firester is described as being for polarizing light in a laser, at line 60 of column 1, and Firester does not disclose whether nor to what extent any line-narrowing and/or line-selection may be performed within a laser resonator.

Applicants' invention as set forth at Claim 3 includes an excimer or molecular fluorine laser system, including a laser chamber filled with a gas mixture at least including a halogen-containing species and a buffer gas, multiple electrodes within the laser chamber connected to a discharge circuit energizing the gas mixture, and a laser resonator including the laser chamber and a line-narrowing and/or line-selection package generating an output beam with a bandwidth less than 1 pm. The recited laser resonator includes a grating element having a dielectric anti-reflective (AR) coating formed thereon. The grating element includes multiple grooves. The grating element selects a narrow band from a broader spectral distribution to continue along the beam path after being incident upon the grating element. The grating element disperses away from the beam path outer portions of the spectral distribution.

As understood, Fig. 1 and column 1, lines 38-47 of Firester, as relied upon by the Examiner, does not disclose all of the features of Applicants' invention as set forth at amended Claim 3. For example, the laser chamber of Applicants' excimer or molecular fluorine laser system is filled with a halogen-containing species and a buffer gas, and Applicants' laser system is of gas discharge type including the multiple electrodes connected to the discharge circuit for energizing the gas mixture within the laser

chamber. No such structure is disclosed at the relied upon portions of Firester. Further, Applicants' laser resonator including the recited line-narrowing and/or selection package generates an output beam with a bandwidth of less than 1 pm. The grating of Firester is described as being for polarizing light in a laser, at line 60 of column 1, and Firester does not disclose whether nor to what extent any line-narrowing and/or line-selection is performed within a laser resonator. Moreover, a dielectric AR coating is formed on a grating element of Applicants' laser resonator. Firester does not disclose such an AR coating. The Examiner's discussion at the top of page 4 of the Office Action is erroneous, because Applicants' recited surface with an AR coating would not be construed as including a surface having a reflectivity of 90%.

CLAIM 8 is rejected as being anticipated by United States patent no. 5,652,681 to Chen. Claim 8, as now amended, is allowable for the reasons that follow.

Applicants' invention as set forth at Claim 8 includes an excimer or molecular fluorine laser system including a laser chamber filled with a gas mixture at least including a halogen-containing species and a buffer gas, multiple electrodes within the laser chamber connected to a discharge circuit energizing the gas mixture, and a laser resonator including the laser chamber and a line-narrowing and/or line-selection package generating an output beam with a bandwidth less than 1 pm. The laser resonator includes a grism element for dispersing the beam. The grism element has a grating surface and a prism portion. The grating surface includes a plurality of grooves. The grism element selects a narrow band from a broader spectral distribution to continue along the beam path after being incident upon the grism element. The grism element disperses away from the beam path outer portions of the spectral distribution.

As understood, Fig. 3, reference numeral 50 and column 4, lines 10-30 of Chen, as relied upon by the Examiner does not disclose all of the features of Applicants' invention as set forth at amended Claim 8. For example, the laser chamber of Applicants' excimer or molecular fluorine laser system is filled with a halogen-containing species and a buffer gas, and Applicants' laser system is of gas discharge type including the multiple electrodes connected to the discharge circuit for energizing the gas mixture within the laser chamber. No such structure is disclosed at the relied upon portions of Chen. Further, Applicants' laser resonator including the recited line-narrowing and/or selection package generates an output beam with a bandwidth of less than 1 pm. The

Serial No.: 09/602,184 Docket No.: LMPY-6410

grism of Firester is not described as being included within a laser resonator, and Chen does not disclose any line-narrowing and/or line-selection package of or for a laser.

Claim Rejections Under 35 U.S.C. 103

CLAIMS 5-7, 9-17, 41 AND 46 are rejected as being unpatentable over United States patent no. 6,160,832 to Kleinschmidt in view of Firester. Claims 5-7 are dependent upon amended Claim 3, and Claims 9-17 and 41 are dependent upon amended Claim 8, and thus each is allowable for the reasons set forth above distinguishing Applicants' invention from that which is disclosed by Firester and Chen, respectively, and Firester and Chen, respectively, do not teach or suggest all of the elements of Applicants' invention as set forth at amended Claims 3 or 8. Claim 46, as now amended, is allowable for substantially the same reasons as amended Claim 8, and further for including a dielectric AR coating on a surface of the grism closest to the laser chamber, and Chen does not teach or suggest all of the elements of amended Claim 46.

It is respectfully further submitted that the subject matter of Kleinschmidt and the invention of each of Claims 5-7, 9-17, 41 and 46 were commonly owned at the time of Applicants' invention. It is therefore respectfully further submitted that Claims 5-7, 9-17, 41 and 46 are allowable because Kleinschmidt may not be relied upon as prior art under 35 U.S.C. 103(a). The prohibition set forth at 35 U.S.C. 103(c) against citing a commonly-owned patent as prior art under section 102(e)/103(a) to reject claims in a patent application applies to patent applications filed on or after ***November 29, 1999***. See MPEP 706.02(l)(1). The present application was filed on June 22, 2000. For each of the above reasons, the rejection is therefore overcome.

CLAIM 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Klenischmidt. Claim 18 has been cancelled rendering its rejection moot.

CLAIMS 19-37, 47-54, 56 AND 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kleinschmidt in view of United States patent no. 5,925,878 to Challener and in further view of United States patent no. 5,383,199 to Laudenslanger et al. As mentioned above, Kleinschmidt may not be relied upon as prior art under 35 U.S.C. 103(a). Moreover, Challener is non-analogous as not relating to excimer or molecular fluorine laser systems, nor to intracavity grating and/or grism optics. For at least each of these reasons, the rejection is overcome.

CLAIM 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kleinschmidt in view of Challener and in further view of United States patent no. 6,115,401 to Scobey. As mentioned above, Kleinschmidt may not be relied upon as prior art under 35 U.S.C. 103(a). Moreover, Challener is non-analogous as not relating to excimer or molecular fluorine laser systems, nor to intracavity grating and/or grism optics. Moreover, Scobey et al. is non-analogous as not relating to excimer or molecular fluorine laser systems. For at least each of these reasons, the rejection is overcome.

CLAIMS 38, 39 AND 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kleinschmidt in view of Challener and in further view of United States patent no. 5,978,409 to Das et al. As mentioned above, Kleinschmidt may not be relied upon as prior art under 35 U.S.C. 103(a). Moreover, Challener is non-analogous as not relating to excimer or molecular fluorine laser systems, nor to intracavity grating and/or grism optics. For at least each of these reasons, the rejection is overcome.

CLAIMS 42-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kleinschmidt in view of Challener. As mentioned above, Kleinschmidt may not be relied upon as prior art under 35 U.S.C. 103(a). Moreover, Challener is non-analogous as not relating to excimer or molecular fluorine laser systems, nor to intracavity grating and/or grism optics. For at least each of these reasons, the rejection is overcome.

In view of the above, it is respectfully submitted that the application is now in condition for the allowance. The Examiner's reconsideration and further examination are respectfully requested.

In the event any fee is required for filing the above-noted document, including any fees required under 37 CFR 1.136 for any necessary Extension of Time to make the filing of attached document timely, the Assistant Commissioner is hereby authorized to charge the fee to our Deposit Account No.: 50-0612. A duplicate copy of this page is enclosed.

Respectfully submitted,
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Dated: 12-02-02

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CLAIM 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kleinschmidt in view of Challener and in further view of United States patent no. 6,115,401 to Scobey. As mentioned above, Kleinschmidt may not be relied upon as prior art under 35 U.S.C. 103(a). Moreover, Challener is non-analogous as not relating to excimer or molecular fluorine laser systems, nor to intracavity grating and/or grism optics. Moreover, Scobey et al. is non-analogous as not relating to excimer or molecular fluorine laser systems. For at least each of these reasons, the rejection is overcome.

CLAIMS 38, 39 AND 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kleinschmidt in view of Challener and in further view of United States patent no. 5,978,409 to Das et al. As mentioned above, Kleinschmidt may not be relied upon as prior art under 35 U.S.C. 103(a). Moreover, Challener is non-analogous as not relating to excimer or molecular fluorine laser systems, nor to intracavity grating and/or grism optics. For at least each of these reasons, the rejection is overcome.

CLAIMS 42-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kleinschmidt in view of Challener. As mentioned above, Kleinschmidt may not be relied upon as prior art under 35 U.S.C. 103(a). Moreover, Challener is non-analogous as not relating to excimer or molecular fluorine laser systems, nor to intracavity grating and/or grism optics. For at least each of these reasons, the rejection is overcome.

In view of the above, it is respectfully submitted that the application is now in condition for the allowance. The Examiner's reconsideration and further examination are respectfully requested.

In the event any fee is required for filing the above-noted document, including any fees required under 37 CFR 1.136 for any necessary Extension of Time to make the filing of attached document timely, the Assistant Commissioner is hereby authorized to charge the fee to our Deposit Account No.: 50-0612. A duplicate copy of this page is enclosed.

Respectfully submitted,
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Serial No.: 09/602,184 Marked-up Copy

In the Abstract

Please replace the original abstract with the following new abstract:

--An excimer or molecular fluorine laser system includes a laser chamber filled with a gas mixture at least including a halogen-containing species and a buffer gas, and multiple electrodes with the laser chamber connected to a discharge circuit energizing the gas mixture. The laser chamber is within a laser resonator generating an output beam. The resonator includes a line-narrowing package for reducing a bandwidth of the output beam. The line-narrowing package includes a grating or grism element for use with a highly reflective (HR) and/or an anti-reflective (AR) dielectric coating. The grating may serve as a resonator reflector having a dielectric HR coating. The grating may be disposed before a HR mirror and thus have a dielectric AR or HR coating when the grating is configured in transmission or reflection mode, respectively. The grating may be used as an output coupler, and may be partially reflective with or without a coating. The grism may have a dielectric AR coating on any transmissive surface and a dielectric HR coating on any reflective surface.--

In the Claims

Please cancel Claims 2, 4, and 18, without prejudice, and amend the claims as follows:

1. (Amended) An excimer or molecular fluorine laser system, comprising:

a laser chamber filled with a gas mixture at least including a halogen-containing species and a buffer gas;

a plurality of electrodes within the laser chamber connected to a discharge circuit energizing the gas mixture;

a laser resonator defining a beam path and including the laser chamber and a line-narrowing and/or line-selection package generating an output beam with a bandwidth less than 1 pm;

the laser resonator including a [A] grating element [for use with a line-narrowing and/or line-selection package of an excimer or molecular fluorine laser] having a dielectric highly reflective (HR) coating formed thereon, the grating element including a plurality of grooves, the grating element selecting a narrow band from a broader spectral distribution to continue along said beam path after being incident upon said grating element, the grating element dispersing away from the beam path outer portions of said spectral distribution.

3. (Amended) An excimer or molecular fluorine laser system, comprising:
a laser chamber filled with a gas mixture at least including a halogen-containing species and a buffer gas;
a plurality of electrodes within the laser chamber connected to a discharge circuit energizing the gas mixture;
a laser resonator including the laser chamber and a line-narrowing and/or line-selection package generating an output beam with a bandwidth less than 1 pm;
the laser resonator including a [A] grating element [for use with a line-narrowing and/or line-selection package of an excimer or molecular fluorine laser] having a dielectric anti-reflective (AR) coating formed thereon, the grating element including a plurality of grooves, the grating element selecting a narrow band from a broader spectral distribution to continue along said beam path after being incident upon said grating element, the grating element dispersing away from the beam path outer portions of said spectral distribution.

5. (Amended) The laser system of Claim [4] 3, wherein the grating element is disposed in front of a resonator reflector element.

8. (Amended) An excimer or molecular fluorine laser system, comprising:
a laser chamber filled with a gas mixture at least including a halogen-containing species and a buffer gas;
a plurality of electrodes within the laser chamber connected to a discharge circuit energizing the gas mixture;
a laser resonator including the laser chamber and a line-narrowing and/or line-selection package generating an output beam with a bandwidth less than 1 pm;
the laser resonator including a [A] grism element [for use with a line-narrowing and/or line-selection package of an excimer or molecular fluorine laser] for dispersing the beam, said grism element having a grating surface and a prism portion, the grating surface including a plurality of grooves, the grism element selecting a narrow band from a broader spectral distribution to continue along said beam path after being incident upon said grism element, the grism element dispersing away from the beam path outer portions of said spectral distribution.

19. (Amended) The laser system of Claim [18] 8, wherein the grism element has a highly reflecting surface for reflecting the beam as a highly reflective resonator reflector.

23. (Amended) The laser system of Claim [18] 8, wherein the grism element is disposed in the laser resonator in front of a highly reflective resonator reflector.

28. (Amended) The laser system of any of Claims [18-19] 8, 19, 21 or 23, wherein the grism element is oriented such that the prism portion serves as a beam expander.

29. (Amended) The laser system of Claim [18] 8, wherein the grism element is disposed in the laser resonator in front of a partially reflective resonator output coupler.

30. (Amended) The laser system of Claim [28] 29, wherein the grating surface has a dielectric AR coating formed thereon.

31. (Amended) The laser system of any of Claims [28-29] 29-30, wherein a beam entry/exit surface of the prism portion has a dielectric AR coating formed thereon.

32. (Amended) The laser system of Claim [18] 8, wherein the grism is disposed within the laser resonator to serve as an output coupling element.

33. (Amended) The laser system of Claim [31] 32, wherein the grating surface faces the laser discharge chamber and has a dielectric AR coating formed thereon.

34. (Amended) The laser system of Claim [31] 32, wherein an entry exit surface of the grism faces the discharge chamber and has a dielectric AR coating formed thereon.

35. (Amended) The laser system of Claim [31] 32, wherein the grating surface faces the laser discharge chamber and is partially reflective such that the grating surface serves as a resonator reflector surface.

36. (Amended) The laser system of Claim [31] 32, wherein a rear surface of the prism portion faces the discharge chamber and is partially reflecting such that the rear surface of the prism portion serves as a resonator reflector surface.

37. (Amended) The laser system of any of Claims [18-24] 8 or 19-24, further comprising a beam expander between the discharge chamber and the grism element.

39. (Amended) The laser system of Claim [37] 38, wherein said plurality of prisms each has at least one dielectric AR coating formed thereon.

40. (Amended) The laser system of Claim [36] 37, further comprising an aperture disposed between the discharge chamber and the beam expander.

41. (Amended) The laser system of Claim [36] 37, further comprising an etalon within the resonator for further line-narrowing and/or line-selection.

42. (Amended) The grating element of any of Claims 1 or 3, further comprising a bulk substrate having a plurality of grooves formed directly therein, wherein the dielectric coating is formed directly [ver] over said substrate and plurality of grooves.

44. (Amended) The laser system of any of Claims [2 or 4] 1 or 3, wherein the grating element further comprises a bulk substrate having [a] said plurality of grooves formed directly therein [, wherein the dielectric coating is formed directly over said substrate and plurality of grooves].

45. (Amended) The laser system of any of Claims [2 or 4] 1 or 3, wherein the grating element further comprises a bulk substrate having a ruled epoxy layer formed thereon having [a] said plurality of grooves [, wherein the dielectric coating is formed over said ruled epoxy layer].

46. (Amended) An excimer or molecular fluorine laser system, comprising:

[including a discharge] a laser chamber filled with a gas mixture at least including a halogen-containing species and a buffer gas;

a plurality of electrodes within the laser chamber connected to a discharge circuit energizing the gas mixture;

[disposed within] a laser resonator [having] including a line-narrowing and/or line-selection package generating [for reducing the bandwidth of the] a laser beam, the laser resonator including a grism element formed from a DUV and/or VUV transparent material, said grism having a prism portion and a grating surface, the grating surface including a plurality of grooves, wherein the surface closest to the discharge chamber has an AR coating formed thereon, the grism element selecting a narrow band from a broader spectral distribution to continue along said beam path after being incident upon said grism element, the grism element dispersing away from the beam path outer portions of said spectral distribution.

47. (Amended) The laser system of Claim [45] 46, wherein said surface closest to said discharge chamber is said grating surface.

48. (Amended) The laser system of Claim [46] 47, wherein a rear surface of said prism portion has a HR coating formed thereon.

49. (Amended) The laser system of Claim [46] 47, wherein a beam entry/exit surface of said prism portion has an AR coating formed thereon, wherein said laser system further comprises a highly reflective resonator reflector after said grism.

50. (Amended) The laser system of Claim [46] 47, wherein a rear surface of said prism portion is partially reflecting such that said rear surface serves as a beam output coupler of the laser system.

51. (Amended) The laser system of Claim [45] 46, wherein said surface closest to said discharge chamber is a beam entry/exit surface of said prism portion.

52. (Amended) The laser system of Claim [50] 51, wherein said grating surface has a HR coating formed thereon.

53. (Amended) The laser system of Claim [50] 51, wherein said grating surface has an AR coating formed thereon, wherein said laser system further comprises a highly reflective resonator reflector after said grism.

54. (Amended) The laser system of Claim [50] 51, wherein said grating surface is partially reflecting such that said grating surface serves as a beam output coupler of the laser system.

55. (Amended) An excimer or molecular fluorine laser system, comprising:

[including a discharge] a laser chamber filled with a gas mixture at least including a halogen-containing species and a buffer gas;

a plurality of electrodes within the laser chamber connected to a discharge circuit energizing the gas mixture;

[disposed within] a laser resonator [having] including a line-narrowing and/or line-selection package generating [for reducing the bandwidth of the] a laser beam,

the laser resonator including a grism element formed from a DUV and/or VUV transparent material, said grism having a prism portion and a grating surface, the grating surface including a plurality of grooves, wherein the surface closest to the [discharge] laser chamber is partially reflecting and serves as a beam output coupler of said laser system, the grism element selecting a narrow band from a broader spectral distribution to continue along said beam path outside the laser resonator after being incident upon said grism element, the grism element dispersing away from the beam path outside the laser resonator outer portions of said spectral distribution.

56. (Amended) The laser system of Claim [54] 55, wherein said partially reflecting surface is said grating surface.

57. (Amended) The laser system of Claim [54] 55, wherein said partially reflecting surface is a rear surface of said prism portion and said outcoupled beam exits said grism through said grating surface.

Please add the following new claims:

--58. (New) The laser system of any of 8, 46 or 55, further comprising a bulk substrate having said plurality of grooves formed directly therein, wherein the dielectric coating is formed directly over said substrate and plurality of grooves.

59. (New) The laser system of any of Claims 8, 46 or 55, further comprising a bulk substrate having a ruled epoxy layer formed thereon having said plurality of grooves, wherein the dielectric coating is formed directly over said ruled epoxy layer.

60. (New) The laser system of any of Claims 8, 46 or 55, further comprising a bulk substrate having said plurality of grooves formed directly therein.

61. (New) The laser system of any of Claims 8, 46 or 55, further comprising a bulk substrate having a ruled epoxy layer formed thereon having said plurality of grooves.--